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(54) Processing packetised data streams

(57) A television viewer can select among a choice of available camera angles and audio feeds when viewing a sporting event such as a football game without changing the television channel. Audio, video and control data are transmitted in packetized data streams (510) with control data providing a pre-assigned channel designation (e.g. channel 10 for network X). A set-top terminal (70) receives and processes the data streams according to user-provided commands. The terminal includes software (560) which can be downloaded via the data streams or installed locally. The control data in the data stream is used to provide an onscreen graphical display on the television (580) that allows the user to select (535) the audio and video which correspond to certain areas of the football stadium, for example. Optionally, the viewer may select alternative story lines in a movie or similar program. A default setting provides primary audio and video signals. Alternative audio and video signals are selected by the user and mapped to the channel designator of the primary signal so that the different camera angles and audio feeds may be seen and heard. The viewer is therefore given the opportunity to customize the programming to enhance the entertainment or educational value.

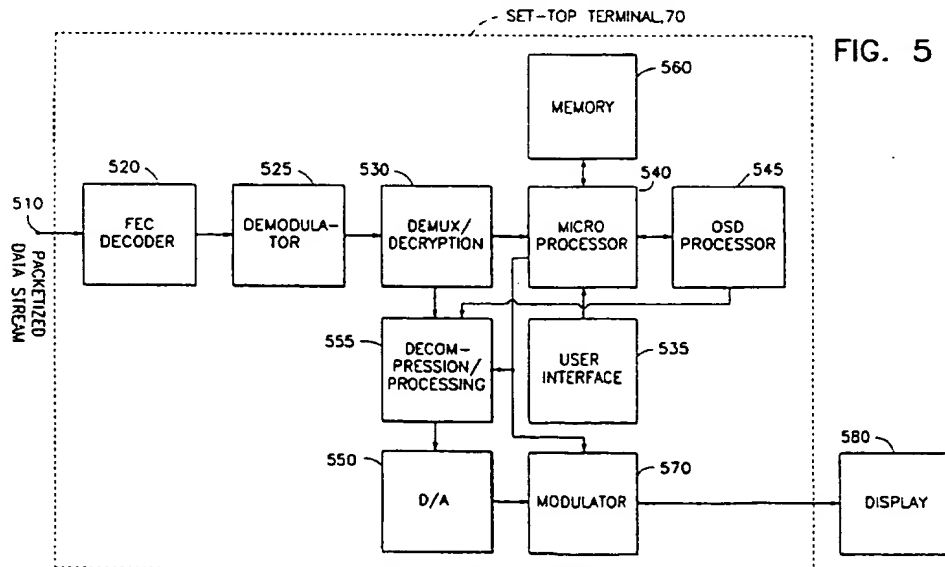
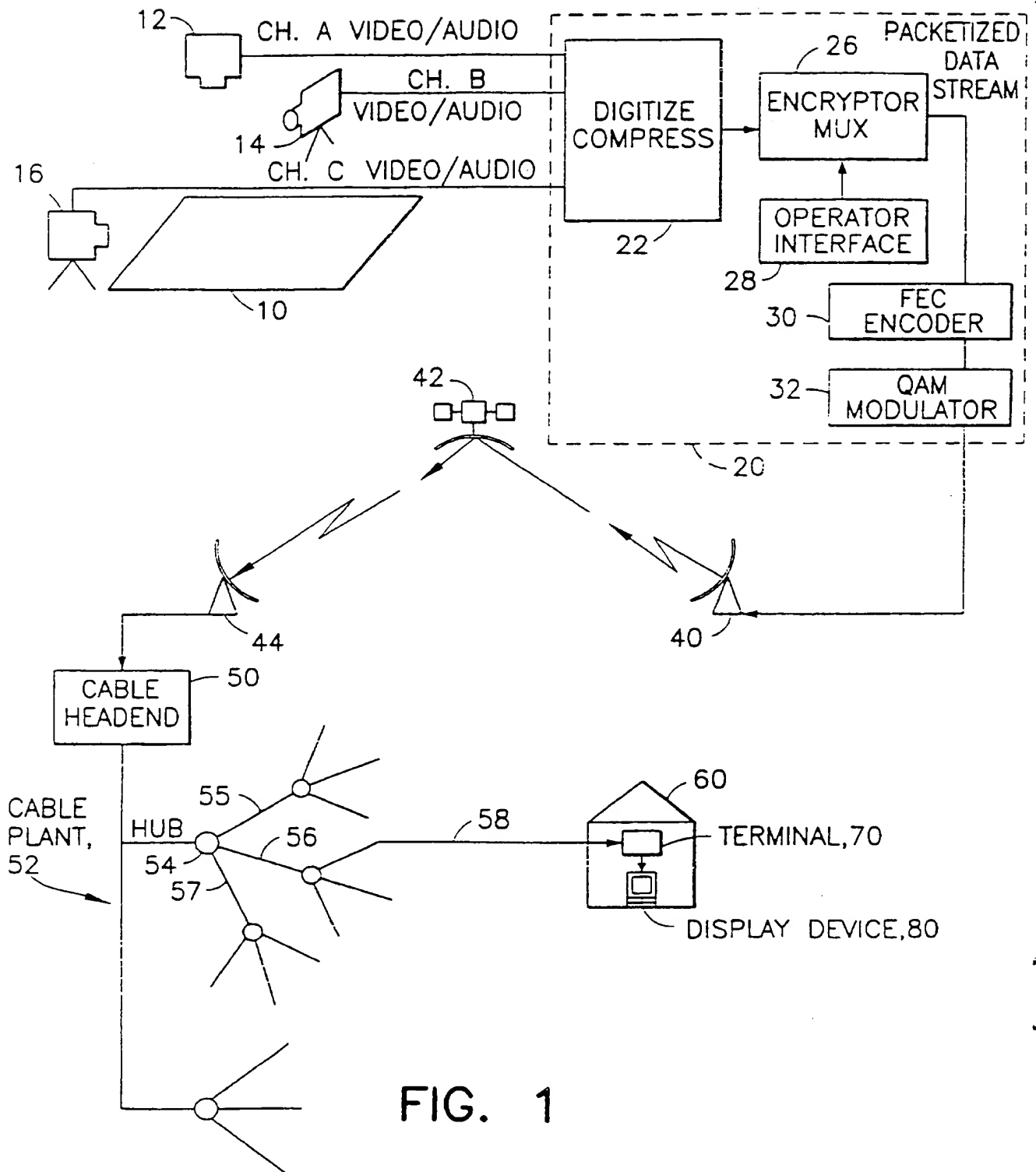


FIG. 5

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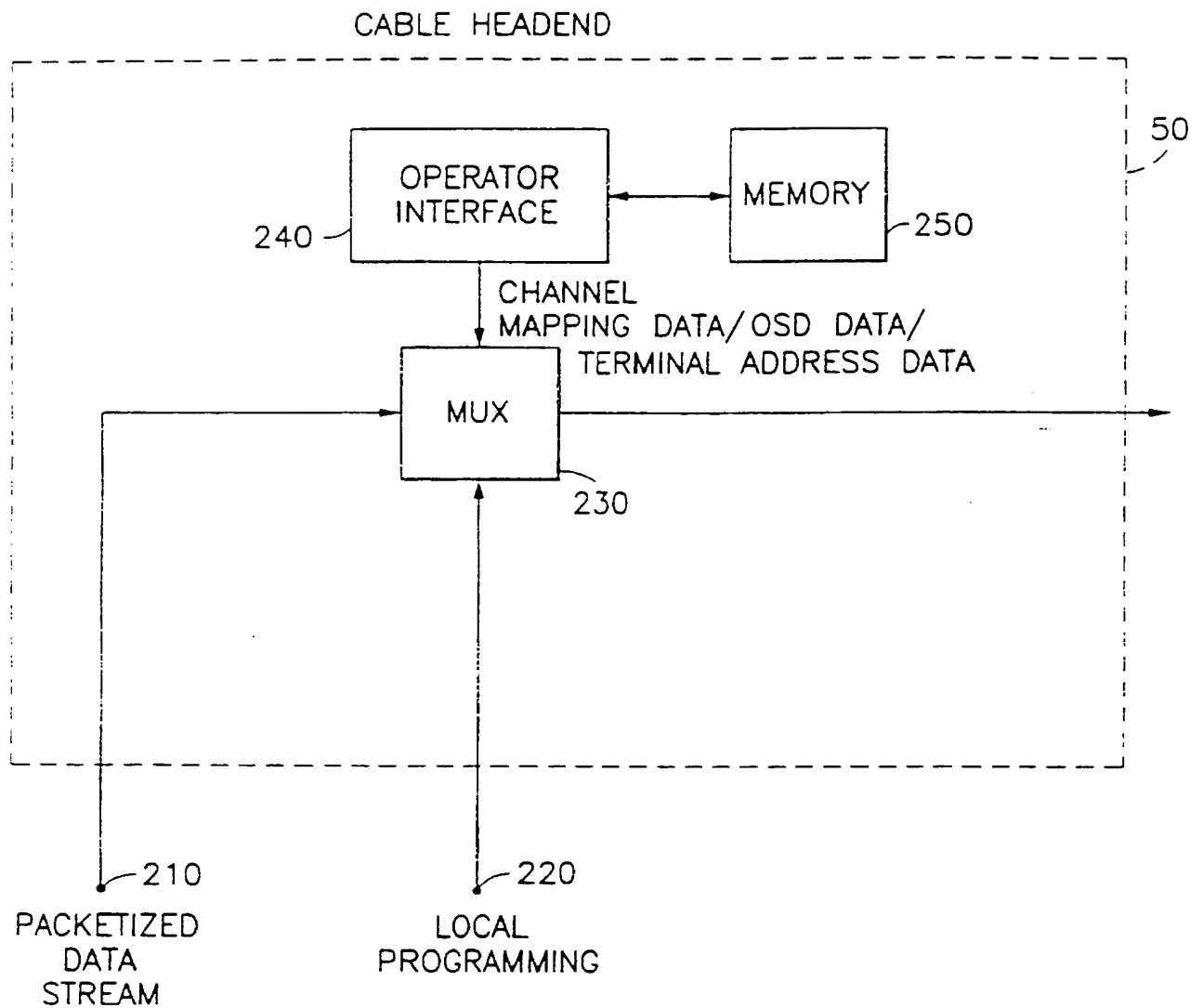


FIG. 2

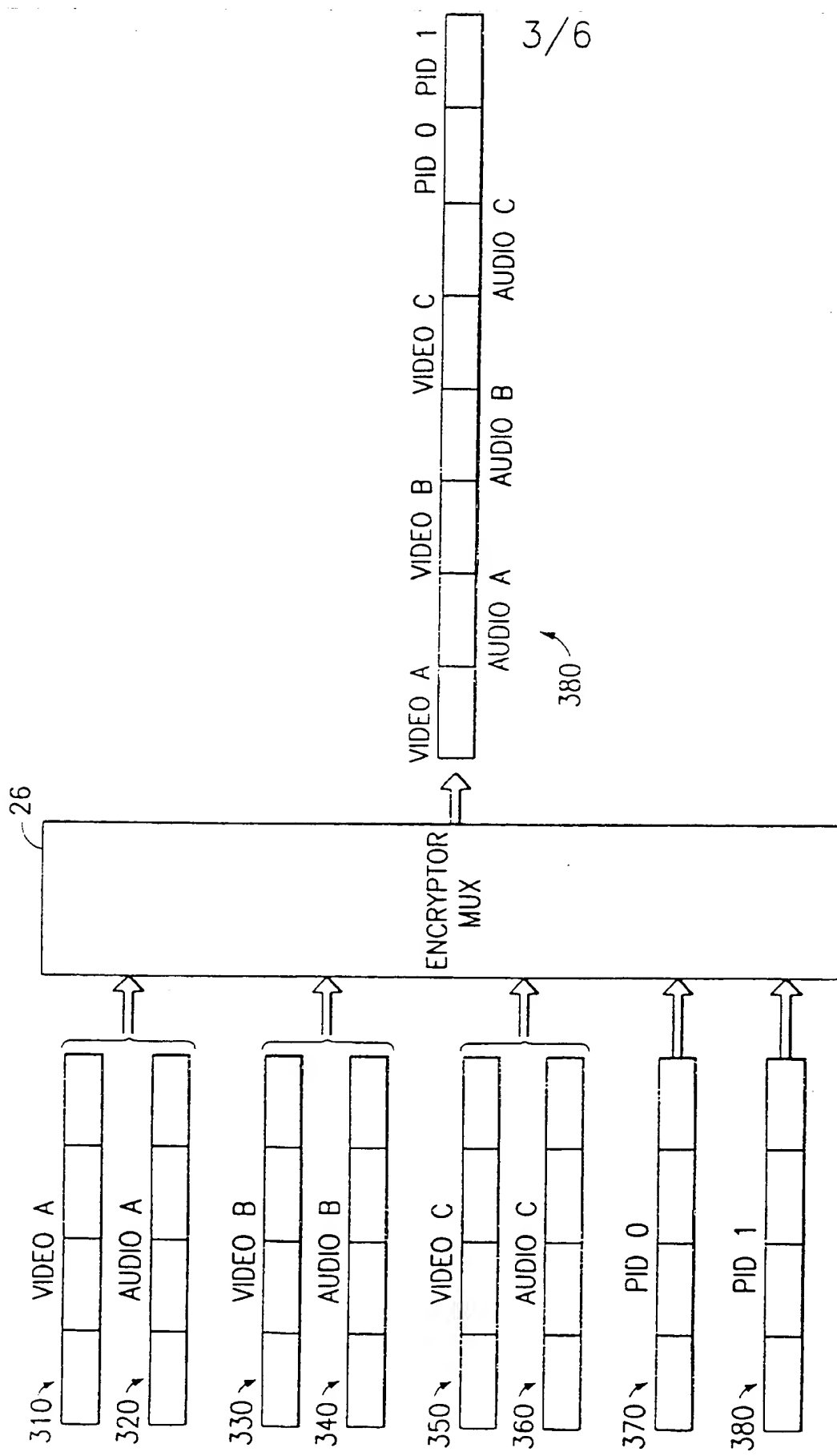


FIG. 3

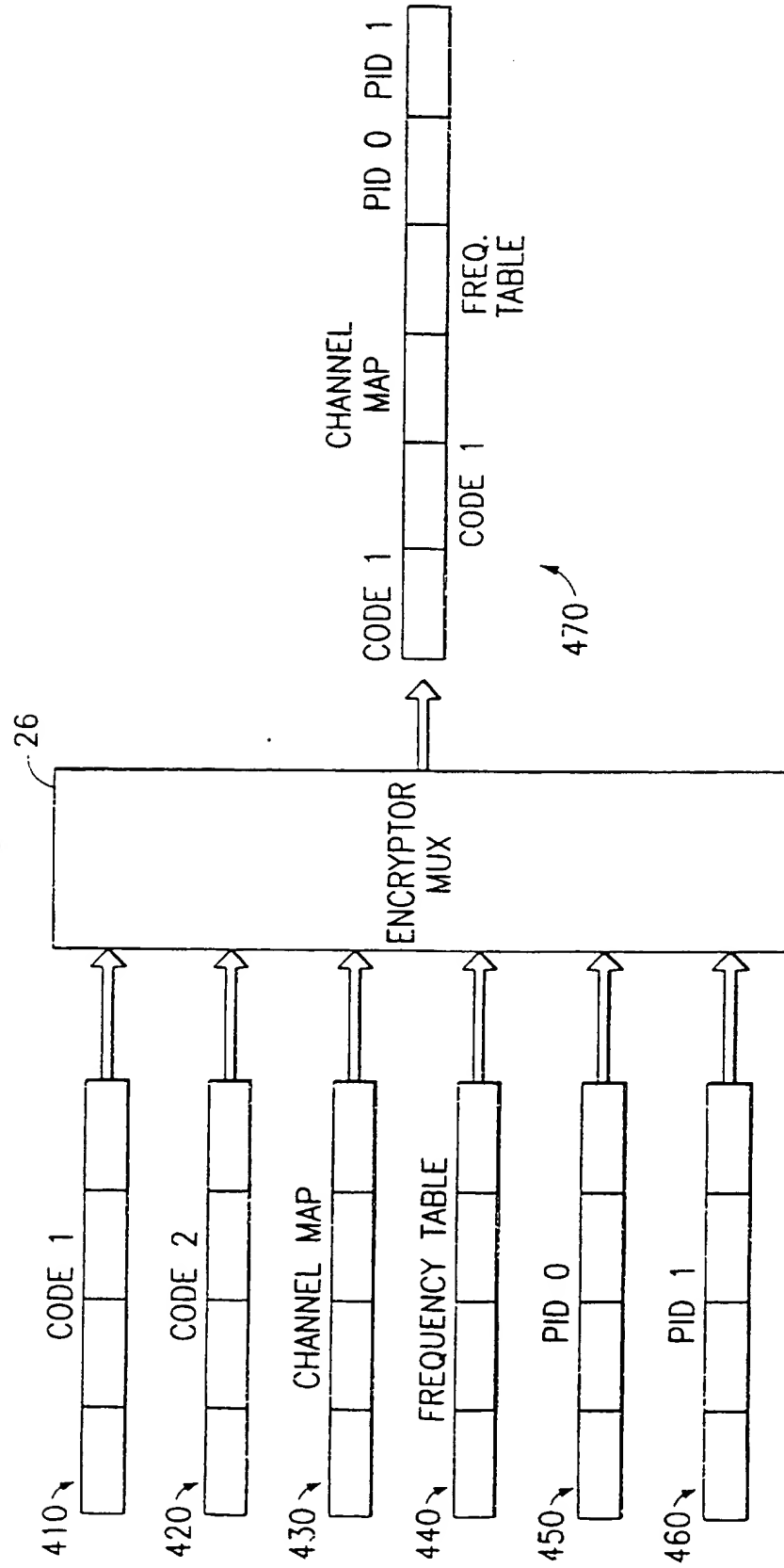
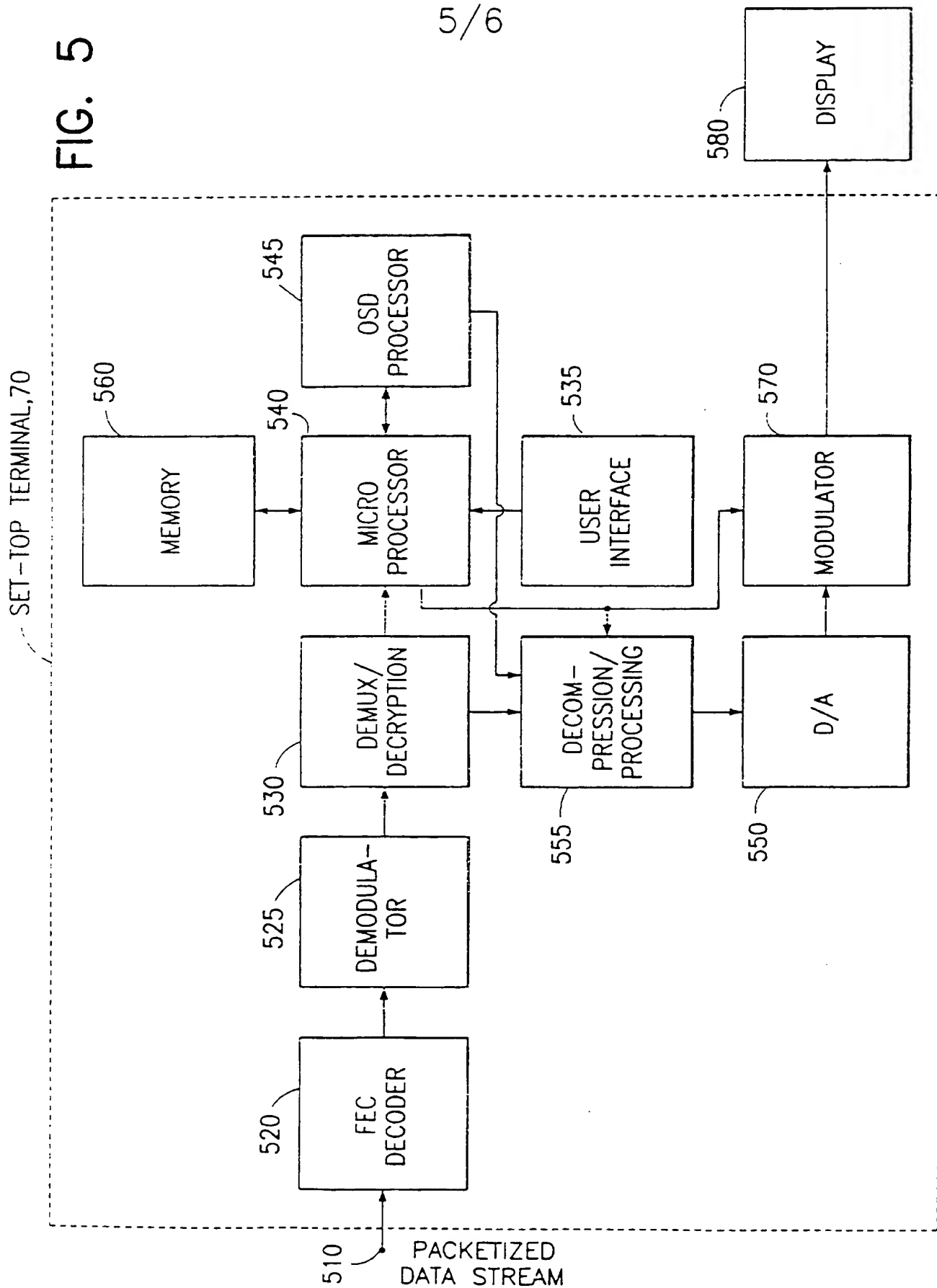


FIG. 4

FIG. 5



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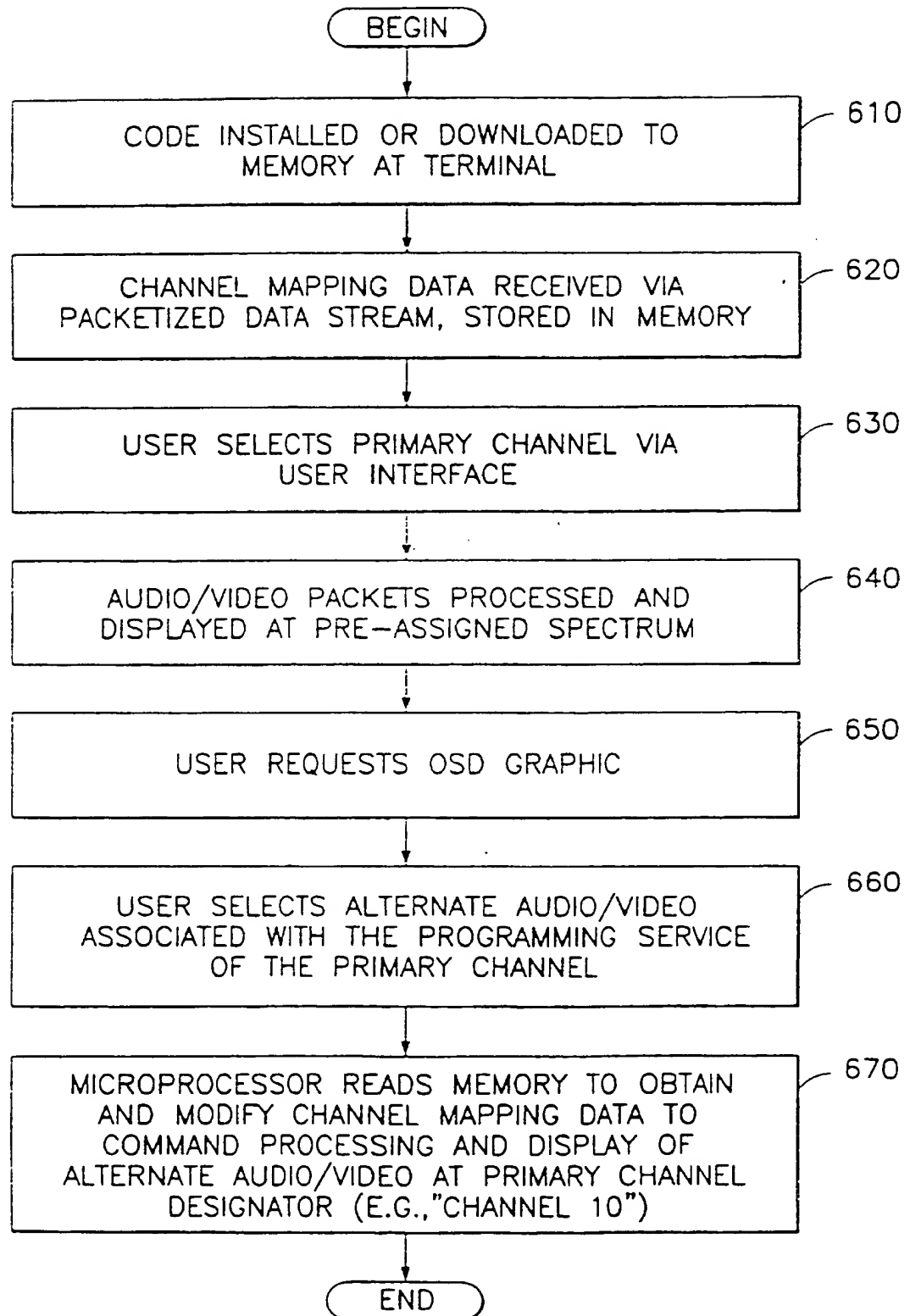


FIG. 6

PROCESSING PACKETIZED DATA STREAMS

5 The present invention relates to processing
packetized data streams, such as audio and video data
at a television set-top terminal.

 Digital transmission of television signals has
become increasingly popular since it can deliver video
10 and audio services of much higher quality than analog
techniques. Digital transmission schemes are
particularly advantageous for signals that are
broadcast via a cable television network or by
satellite to cable television affiliates and/or
15 directly to home satellite television receivers. It is
expected that digital television transmitter and
receiver systems will replace existing analog systems
just as digital compact discs have replaced analog
phonograph records in the audio industry.

20 However, a substantial amount of digital data must
be transmitted in any digital television system.
Furthermore, transmission bandwidths and carrier
frequencies are often constrained by the need to
maintain compatibility with existing equipment.
25 Conventional analog radio-frequency (RF) television
programming is transmitted in an assigned 6 MHz
bandwidth in the spectrum from 54 to 890 MHz. For
example, conventional televisions recognize "channel
three" as the designation of the television signal in
30 the spectrum from 60 to 66 MHz, while "channel four" is
assigned the spectrum from 66 to 72 MHz. Moreover, in

many digital set-top terminals, the received audio/video signal is converted to a predefined spectrum, typically channel three or four, before being provided to the television for display.

5 While a digital television signal is converted to a television-compatible spectrum at the terminal, the signal may be transmitted to the terminal from the service provider in a variety of ways. For example, the digital transmission may be provided over a cable
10 system, or via satellite at a frequency (e.g. 1.2 GHz) which is well above the terrestrial broadcast band. Transmission within the assigned 6 MHz bandwidth is known as an "in-band" transmission, while transmission outside of this region is known as an "out-of-band"
15 transmission. Moreover, while video and audio data which comprise a television program are transmitted in the 6 MHz band, auxiliary control data for all channels is transmitted out-of-band (e.g. at 75.25 MHz).

 Digital transmission techniques are superior to
20 analog techniques since they can use the available spectrum more efficiently. For example, using known digital compression techniques, up to ten conventional television programs may be carried in a 6 MHz bandwidth with standard resolution. Proposed high-definition
25 television (HDTV) systems provide greater resolution but consume additional bandwidth.

 One way to transmit compressed digital data to a receiver is in the form of packets contained within a packetized data stream. Typically, the packets
30 carrying the compressed video data will be multiplexed

with other packets which, for example, carry
corresponding audio data and control information which
are necessary to reconstruct a television signal. One
standard for transporting digital television signals in
this manner is the MPEG-2 standard, details of which
5 can be found in document AVC-491, version 1, April,
1993 published by the Telecommunications
Standardization Sector, Study Group 15, Experts Group
4ATM-Video Coding of the International Organization for
Standardization, ISO-IEC/JTC1/SC29/WG11 entitled "Coded
10 Representation of Picture and Audio Information,"
incorporated herein by reference. Further details of
the video syntax and semantics for MPEG-2 video can be
found in International Organization for Standardization
document ISO/IEC 11172-6 dated April 2, 1993 and
15 entitled "Revised Syntax and Semantics for MPEG-2
Video," also incorporated herein by reference. Also of
interest, and incorporated herein by reference, is
document MC68VDP/D, a preliminary data sheet entitled
20 "MPEG-2/DCII Video Decompression Processor," ©Motorola
Microprocessor and Memory Technologies Group, 1994
which describes a video decompression processor using
the MPEG-2 and DigiCipher®II standards.

In the MPEG-2 system (and the similar DigiCiphers®
25 II system proprietary to General Instrument
Corporation, the assignee hereof) a transport stream,
or transport multiplex is made up of a contiguous set
of fixed length packets. Each packet is 188 total
bytes in length, with the first four of those bytes
30 being defined as the packet header. The payload

portion of each packet, which includes either video, audio or other data, is thus normally 184 bytes. However, a variable length adaptation field may be provided to extend the header, when required. When an adaptation field is present, the payload portion of the packet will be correspondingly shorter.

Furthermore, various timing and identification information is provided in different portions of the transport stream. These include a packet identifier (PID) found in the transport header of each transport packet to provide a reference number for identifying the transport packets carrying a specific service component. This number is included in a service definition (e.g. service map, or channel map) used by the receiver to identify those transport packets required to reconstruct a television program signal. The PID may also be referenced for various grooming and remultiplexing functions. In the case of video, audio or isochronous control data, the stream of packets labelled with a single PID represents a single video, audio or isochronous data service elementary stream, respectively. Each type of packet will have a different PID identifying the packet type.

The packetized data stream of a programming service is received by a subscriber via a receiver/descrambler that is typically embodied in a set-top terminal. The terminal decompresses and decodes the digital data and provides the corresponding video, audio and data to an output device (e.g. a television, video recorder, and/or separate

high-fidelity audio system). In particular, the viewer selects a channel designation (e.g. channel 2) that corresponds to a particular programming service provider (e.g. network X). The channel map data of the packetized data stream maps the data from the channel designator to the corresponding programming service provider. For example, when a viewer selects "channel 2" on the set-top terminal, programming from "network X" will be processed at the terminal and provided to the television at a fixed, pre-defined carrier frequency, for example in the spectrum from 60 to 66 MHz (television channel 3).

Moreover, data carried in the packetized data stream may be used by a graphics processor in the terminal to provide an on-screen display of available programming. For example, the display may provide a program guide which lists the program name, viewing time and channel. Additionally, such data may be addressed to particular terminals to provide individual account and billing information.

When the viewer selects a particular programming service to view, the corresponding data packets are retrieved and decompressed to allow reconstruction of the corresponding video and audio signal. In particular, data packets with the appropriate PID are demultiplexed, unpacked and provided to a video decompression processor. Finally, the video and audio signals are modulated at a specific carrier frequency and provided to the television for display.

As can be seen, the advent of digital television

transmission techniques provides high fidelity video and audio to subscriber's homes, and further provides the opportunity for new services and features for both entertainment and educational purposes. Moreover, such programming presents lucrative marketing opportunities for service providers and others who market programming to specific demographic groups, including, for example, those who enjoy sports programs, movies, children's programs and the like.

The present invention according to one aspect provides a method and apparatus for allowing a television viewer to control the re-mapping of channel assignments in a digital video decoding terminal in order to access alternative video and/or audio signals of a programming service provider.

According to another aspect of the invention a terminal is provided for processing a packetized data stream which includes data from primary and alternative signals of a first programming service (e.g. network X); the primary signal is associated with a first channel designator (e.g. channel 10); the channel designator is used to inform the viewer that he can view a particular programming service at a particular channel which is indicated by the terminal.

The terminal also includes means for mapping the alternative signal to the first channel designator. Thus, the alternative signal, such as an audio/video signal, can be found by the viewer at the same channel as the primary channel. The viewer, who has come to associate "channel 10" with "network X" therefore knows

that he is still viewing a program of network X, even though he has the opportunity to view and listen to a number of alternative video and audio selections.

5 The mapping means may be responsive to a selection command such as that provided via a microprocessor. The selection command may be a default command that occurs when the viewer does not select alternative audio/video, when the alternative service is not available for a given programming service at a given
10 time, or when the viewer has not been authorized to access the alternative audio/video.

 Such a terminal also includes means for providing the data of the alternative signal to a device for reproduction of a video and/or audio program. This may
15 include, for instance, a video decompression processor and a modulator which provides a signal having a carrier frequency which is compatible with the television or display monitor.

 The terminal may also process data from a second
20 programming service (e.g. network Y), which has a second channel designator (e.g. channel 11). The user can select the data of the second programming service to be displayed under the first channel designator (channel 10). This may be useful, for instance, when
25 two or more service providers cover the same event and the viewer wishes to have unified control of all available audio and video options.

 The terminal may include a user interface such as a hand-held remote control unit which is responsive to
30 a user-provided command. If the user does not enter a

command to access the alternative audio/video, a default setting in the terminal may provide the data of the primary audio/video signal to the television.

5 In a particularly advantageous embodiment, the terminal includes an on-screen display (OSD) graphics processor which allows the viewer to interact with the terminal via a graphical display to allow the user to select among the available audio/video signals. The user may choose to view both the primary and
10 alternative video signals, for example, in a split-screen or picture in picture format, while listening to only one of the audio signals.

In an alternative embodiment, the terminal processes a packetized data stream including data
15 corresponding to a signal of a first programming service, which is associated with a first channel designator, and a signal of a second programming service. The terminal includes mapping means responsive to a selection command for mapping the
20 signal of the second programming service to the first channel designator. Additionally, the terminal includes means responsive to the first channel designator for providing the data of the signal of the second programming service to an output device for
25 reproduction. The signal of the second programming service may be associated with a second channel designator which is different from the first channel designator.

Corresponding methods are also presented and other
30 aspects of the invention are exemplified by the

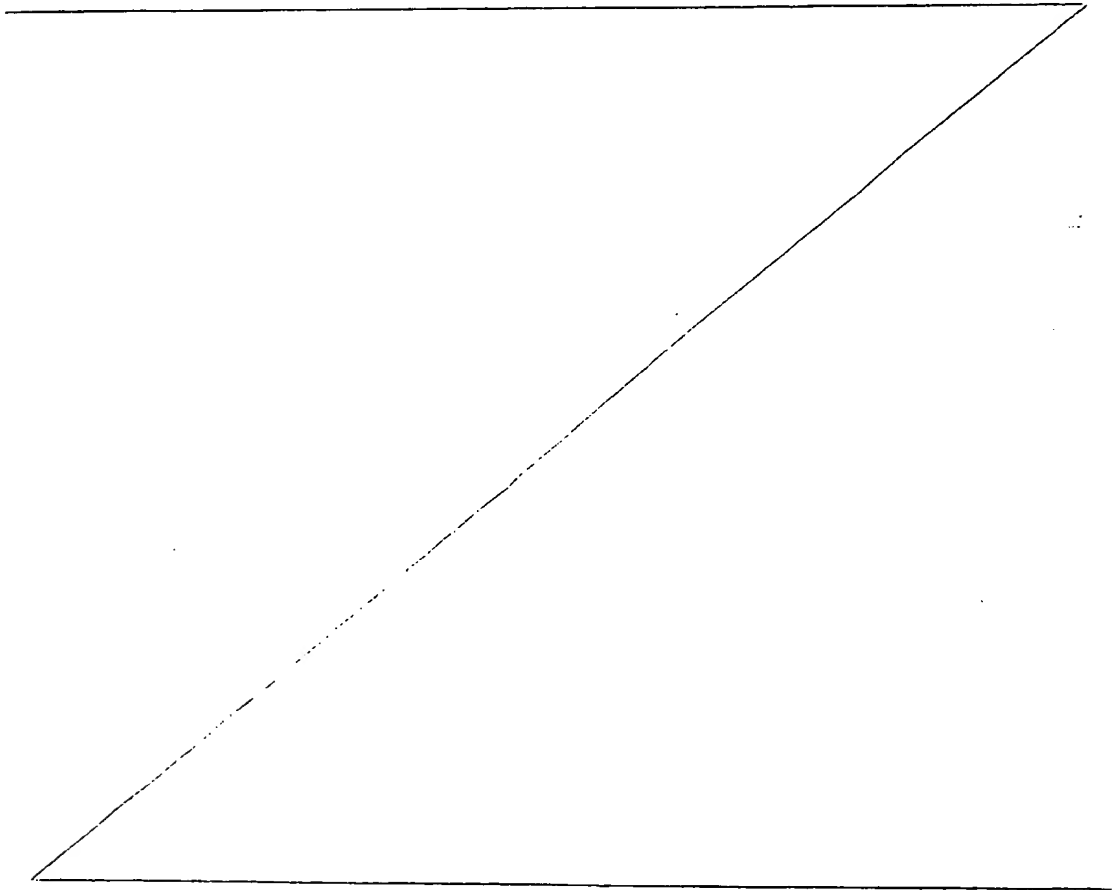
attached claims.

Accordingly, it will be seen that it is possible to provide a digital transmission system for re-mapping the channel assignment of one or ore selected audio and video signals of a programming service. Furthermore, such re-mapping can occur according to user-provided commands. Additionally, one can provide a graphical user interface to assist the user in selecting the audio and video signals. The user interface is preferably able to group the alternative audio and video signals which are associated with a primary channel of a programming service. The system is preferably able to group additional audio and video signals of an additional programming service provider when, for example, two or more service providers are covering the same event. Furthermore, the system is preferably compatible with existing packetized data transmission protocols and channel assignment data provided by programming service providers and/or cable system headend operators.

Such a system can have numerous advantageous applications. For instance, a viewer could tune in to a primary channel which was associated with a particular programming service. The programming service could provide additional video and audio choices that the viewer could select. For example, a viewer watching a sports event could select different camera angles and different audio feeds that are provided on the different audio and video signals of the service without tuning away from the primary

channel. The selection process could be carried out via an on-screen display (OSD) that is intuitively easy for the viewer to operate. For instance, a display of a football stadium with different
5 color-coded or numbered regions can allow the viewer easily to select the desired viewing angle, thereby providing the sensation that the viewer is actually in the stands.

10 Furthermore, such a system is preferably arranged so that other channel assignments remain intact, thereby enabling other viewers to view other primary channels at another television in the same home at the usual pre-assigned channel designation.



For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

5 Figure 1 is a diagrammatic illustration providing an overview of an encoding, transmission, reception, and distribution scheme;

Figure 2 is a diagrammatic illustration of a cable distribution system headend;

10 Figure 3 is a diagrammatic illustration of an in-band packetized data stream;

Figure 4 is a diagrammatic illustration of an out-of-band packetized data stream;

15 Figure 5 is a block diagram of a set-top terminal; and

Figure 6 is a flow chart illustrating a user selection process.

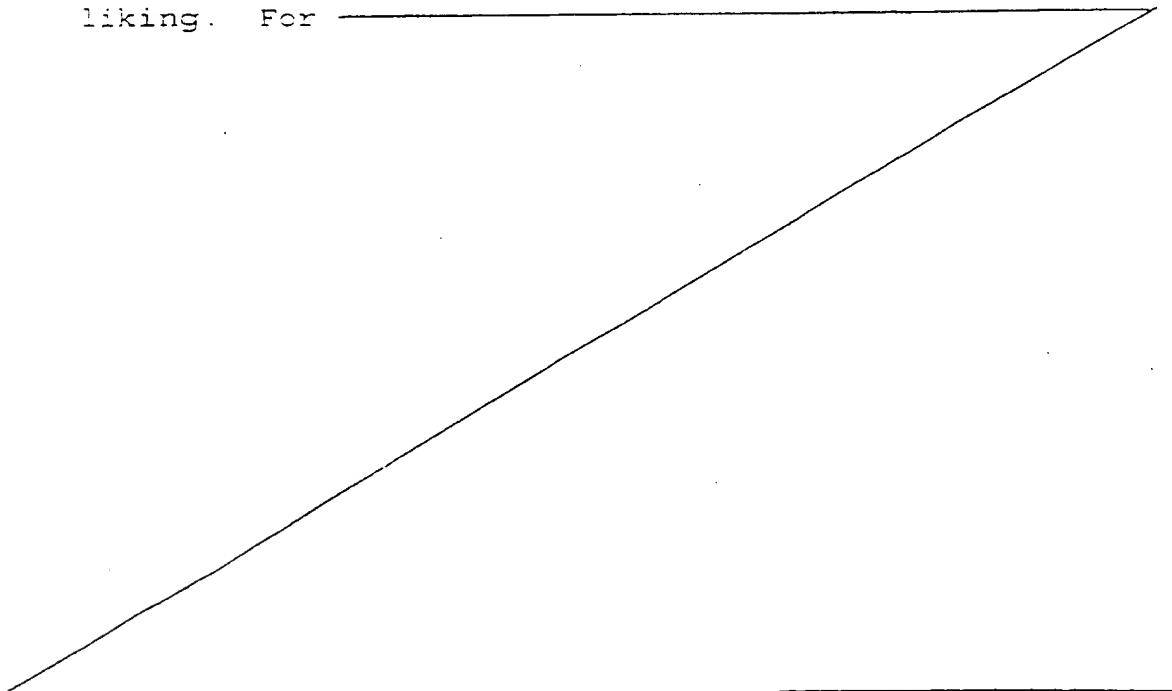
20 The present embodiment allows a television viewer to select among a choice of available camera angles and audio feeds when viewing a program such as a football game. An interactive graphical display informs the user of the available options.

25 Currently, in many broadcast events such as a football game or other sports event, service providers use several cameras and audio feeds in order to provide viewers with a variety of camera angles and sounds. For instance, over twenty cameras are typically used in a professional football game broadcast. The service provider therefore must decide which camera angle and
30 audio feed are transmitted to the viewer based on its

best judgment of what the viewer is interested in.

This inevitably results in many compromises, since a particular viewer may prefer a particular camera angle, such as an overhead view, while another viewer prefers a close-up sideline view. Moreover, one viewer may prefer to hear the game broadcast by a first announcer, while another prefers a second announcer. The announcers may provide alternate language broadcasts, or may slant the coverage toward one of the participating teams. Alternatively, a viewer may not want to hear the announcer at all, but may wish to listen to a field-level audio feed. In accordance with the present embodiment, the viewer can act as his own programming director and easily switch between available video and audio signals.

Alternatively, the invention may be used with other types of programming to allow the viewer to interact with, and customize, the programming to his liking. For



instance, in a movie transmitted by a service provider, the viewer may be afforded the opportunity to select different story lines and plot characters. At predefined points in the movie, the program will pause and the viewer can select from a variety of options. In accordance with the viewer selection, the corresponding programming segment is displayed.

As a further example, the invention may be used for educational purposes. For instance, an educational lecture with a multiple choice exam may be broadcast to the viewer. Depending on the viewer's selected answer, a corresponding programming segment will be displayed which informs the viewer if his answer was correct. Then, a programming segment corresponding to either a review lecture or a more advanced lecture can be displayed.

Numerous other applications exist which would benefit from allowing a viewer to customize programming to enhance its entertainment and educational value.

Figure 1 is a diagrammatic illustration providing an overview of an encoding, transmission, reception, and distribution scheme.

In one embodiment of the invention, a sporting event played on a field 10 is monitored by video cameras 12, 14 and 16, which include corresponding audio feeds. Cameras 12, 14 and 16 provide video and audio signals on channel A, channel B and channel C, respectively as shown. While three cameras and audio feeds are shown, it will be understood that additional cameras and audio feeds may be provided on additional channels. Furthermore, the audio feeds need not be associated with particular cameras.

The video and audio signals from channels A, B and C are provided to a processing function 22 of a transmitting

apparatus 20. The transmitting apparatus 20 is typically located near the field 10 in an equipment vehicle used by the programming service provider. The processing function 22 digitizes and compresses the video and audio signals of channels A, B and C. Function 22 provides a packetized data stream that includes video, audio and other data in separate packets, each of which is identified by a particular PID. The packetized data stream may conform to the aforementioned MPEG-2 or DigiCipher® II standards.

The packetized data is combined with control messages from an operator interface 28 at multiplexer/encryptor 26. The control messages include information on the locations of the video cameras and audio feeds. For instance, the control messages will specify that video camera 16 is located at the end-zone of the field 10, video camera 14 is located at the sideline, and video camera 12 provides an overhead view of the field 10. The control messages may also specify that a particular audio feed is associated with a particular video camera, and may specify that a particular video and audio signal, e.g., channel A, is a default or primary signal which should initially be displayed on the viewer's television.

The control message may further include graphics data which, for instance, provides a graphical display of the field 10 and the relative locations of the cameras and audio feeds. Additionally, the control messages may include code download packets, channel map information, frequency table information and virtual channel assignments. A code download packet includes computer software that is to be downloaded to a viewer's set-top terminal. The code controls the operation of the

terminal, including the associated user interface and OSD processor. The channel map information assigns a particular transmission spectrum to a particular programming service provider. Information transmitted
5 over a particular spectrum may be re-transmitted over a different spectrum as long as a sufficient channel bandwidth is maintained. The channel map information accesses the frequency table information to accomplish this task. A virtual channel assignment associates a
10 particular channel designator (e.g. channel 10) with a corresponding programming service provider (e.g. network X).

Encryption takes place at function 26 in accordance with one or more specified cryptographic keys to prevent
15 unauthorized viewers from accessing the programming. Such encryption techniques are well known in the art. The packetized data stream exiting from function 26 is then provided to forward error correction (FEC) encoder 30, and then modulated at QAM modulator 32 to provide a packetized
20 data stream that is ready for transmission.

The packetized data stream is transmitted via antenna 40 to a satellite 42 and antenna 44. Although a satellite transmission path is shown, it will be understood that other transmission paths may be employed,
25 such as cable links and so-called wireless cable, which operates at microwave frequencies. The packetized data stream is provided to a cable headend processing function 50, where it may be combined with programming received from other sources, such as local television stations.
30 Additionally, control data is added by the headend system operator to control distribution of the programming.

The packetized data stream is then transmitted via the cable plant, shown generally at 52, to a number of subscribers in their homes or businesses. Conventionally, a hub and spoke distribution system is provided including a representative hub 54, and representative links 55, 56, 57 and 58. Link 58 provides the data stream to the set-top terminal 70 in a subscriber's home 60 for display on a display device 80 such as a television. Alternatively, the data stream can be provided to the subscriber's home directly from satellite 42, via a home satellite receiver.

Figure 2 is a diagrammatic illustration of a cable distribution system headend 50.

The packetized data stream is received at terminal 210 and provided to a multiplexer 230. Local programming is received at terminal 220 and also provided to the multiplexer 230. The multiplexer 230 further receives data from an operator interface 240 which communicates with a memory 250.

The operator interface 240 may provide channel mapping data, on-screen display graphics data, and terminal address data. For instance, the channel mapping data will specify that a particular programming service (e.g. network X) will be provided on a particular channel designator (e.g. channel 10) of a set-top terminal. In some cases, the desired channel mapping data will already be included in the data stream. Generally, the headend operator will have preset channel assignments for the different service providers. Moreover, the number of alternate audio and video signals provided from a particular service provider may vary. Accordingly, the headend operator may map the primary audio and video channel from the service provider to a new channel

designator, and may map the alternative audio and video channels to other channel designators that are not currently assigned.

Alternatively, the headend operator may insert
5 control data via the multiplexer 230 that groups the audio and video signals of the packetized data stream and local programming together. For example, the audio of a local announcer provided via terminal 220 may be grouped with the video of the packetized data stream provided via
10 terminal 210. In this manner, local viewers may listen to a local announcer's coverage of a nationwide network broadcast event. Furthermore, the headend operator may provide control data that groups audio and video from different service providers, such as when two or more
15 service providers cover the same event. The viewer may then access all available programming via a single graphical interface, to be discussed in greater detail below.

Additionally, the headend operator has the
20 opportunity to group particular audio and video signals from the packetized data stream according to a tiered marketing scheme. For instance, viewers who pay for a basic level of service may be authorized to access only a primary audio/video signal broadcast of an event. Other
25 viewers who pay an additional fee can be authorized to access some or all of the other available audio and video feeds. The audio/video may also be grouped according to a rating scheme based on, e.g. adult content, violence or the like.

30 Channel mapping data, OSD data, and terminal address data may be stored in memory 250 for use by the operator interface 240. While some graphics data may be provided

in the packetized data stream received via 210, the headend operator may provide additional graphics data for use in an OSD at the viewer's television. For example, the display may provide a program guide which lists the program name, viewing time and particular channel mapping scheme. Other marketing information may be provided to allow the viewer to order additional services from the cable operator.

As noted above, however, the packetized data stream may alternatively be transmitted directly to an antenna at the viewer's home. Such transmissions, known as Direct Broadcast Satellite (DBS) transmissions, do not require intervention by a cable system headend such as the headend 50 of Figure 2. However, in such an embodiment, various control data and the like can be inserted at the satellite uplink in much the same way that it can be added at a cable system headend.

Figure 3 is a diagrammatic illustration of an in-band packetized data stream.

The packetized data stream from function 22 in Figure 1 is provided to encryptor/multiplexer 26. The data stream includes channel A video packets 310, channel A audio packets 320, channel B video packets 330, channel B audio packets 340, channel C video packets 350, and channel C audio packets 360. Also included are in-band control data packet PID 0, shown at 370, and in-band control data packet PID 1, shown at 380. The audio and video packets of a particular channel are shown grouped in a video/audio pair, but this is not required. For instance, an audio feed can be provided without an accompanying video feed.

The audio and video data packets are time-multiplexed by multiplexer 26 to provide the packetized data stream 380. The data stream 380 is modulated at a specific carrier frequency according to the transmission
5 scheme (e.g. via cable or satellite) and the programming service provider. For example, network X may use a 6 MHz bandwidth at a carrier frequency of 1.2 GHz to broadcast its signal over the satellite link (40, 42, 44) of Figure 1. Moreover, the ten channels carried in a 6 MHz
10 bandwidth may correspond to one or more programming service providers. Similarly, a single service provider may consume a spectrum of more than 6 MHz.

Figure 4 is a diagrammatic illustration of an out-of-band packetized data stream in accordance with the
15 present invention. The packetized data stream from operator interface 28 in Figure 1 is provided to encryptor/multiplexer 26. The data stream includes "code 1" download packet 410, "code 2" download packet 420, channel map packets 430, frequency table packets 440, and
20 out-of-band control data packets PID "0" 450 and PID "1" 460.

The control message data packets are time-multiplexed by multiplexer 26 to provide the packetized data stream 470. The data stream 470 is modulated to a
25 specific carrier frequency (e.g. 75.25 MHz) that is out of the band used for transmission of the data packets 380 of Figure 3.

Figure 5 is a diagrammatic illustration of a set-top terminal.

The
30 set-top terminal 70 shown is used in conjunction with a cable distribution system. Alternatively, in a DBS system, the terminal 70 may receive transmissions directly

from a satellite. In either case, one or more packetized data streams are received at input 510, then provided to an FEC decoder 520 and a demodulator 525. The demodulator 525 has the capability to demodulate both in-band and out-of-band data streams. In the demodulation process, the modulated signal is mixed with a signal having the same carrier frequency, thereby providing the packetized data stream in a baseband signal.

The demodulated packetized data stream is then provided to demultiplexer/decryptor 530, where the encrypted data packets are decrypted and separated into two data paths. In a first path, control data packets such as packets 470 from Figure 4 are provided to a microprocessor controller 540, such as the Model 68331 processor manufactured by Motorola Corporation. In the other path, video and audio packets are provided to a processing and decompression function 555.

The control data packets, which include code download packets, channel map packet data, frequency table packet data, and other miscellaneous control data are received and stored in memory 560, which may comprise a random access memory (RAM). The object code from the code download packets is executed by the microprocessor 540 and OSD graphics processor 545 to provide the alternative audio and video capabilities of the present invention. For instance, the "code 1" packets 410 may include code related to on-screen graphics, while the "code 2" packets 420 relate to channel mapping and grouping. Additional or fewer code packets may be provided as required.

Alternatively, the code need not be downloaded from the packetized data stream, but may be installed at the terminal 70 locally, either at the time of manufacture, or

by the viewer via an access port and a so-called "smart card." A smart card is a credit-card shaped object that includes a memory for storing code. When inserted into an access port of a terminal, the code is downloaded to the terminal's memory. Channel map packet data, frequency table packet data, and other miscellaneous control data is also received by the microprocessor 50 and stored in memory 560 as required. As mentioned, the channel map data and frequency table data assign the data packets of the various programming services to channel designators according to a PID in each incoming data packet.

The microprocessor 540 also receives a signal from a user interface 535, which is responsive to viewer commands. Such commands may be issued via an infra-red light emitting remote control, a touch-sensitive screen, voice recognition, or other convenient mechanism. In accordance with the present invention, the OSD graphic processor 545 and display device 580 provide a particularly advantageous arrangement. The OSD processor 545 receives OSD data provided by either the programming service provider and/or by a cable headend. The OSD data allows the processor 545 to provide a variety of graphical displays on the display device 580, which may be a standard television, or alternatively, the graphics display may be provided on a separate display device such as a video monitor (not shown). The display device 580 reproduces the data of the audio and video signals.

In response to OSD data received via the packetized data stream and the code download packets, the OSD processor 545 can create a graphical display that informs the viewer of the various audio and video options available. For instance, a graphical display of a

football stadium may show various segments of the stadium as color-coded or numbered regions. Icons which represent available viewing angles and audio feeds may also be used. The graphical display may allow the viewer to choose team-specific video and audio configurations that will provide coverage that is slanted toward the home team, for instance (e.g. press "1" for home team coverage). In this case, the audio would include announcers which are partial to the home team, while the video includes additional coverage of the home team. Similarly, the graphical display provided by the OSD processor 545 can allow the viewer to select audio and video which provide post-game interviews of the home team or the visiting team. Other display options will be more suitable for other applications. For instance, a display associated with an educational program may include a multiple-choice quiz format which instructs the viewer to provide an answer by pressing a corresponding button on a hand-held remote control.

Thus, the display will instruct the viewer to press a particular key on a hand-held remote control infra-red transmitter, for instance, to receive particular audio and video signals on the display device 580. The display can inform the viewer of the default audio and video settings, or provide the viewer with instructions as to changing the default settings. The user interface 535 will receive the viewer's commands and provide them to the microprocessor 540 and memory 560. The memory may store information that identifies the particular viewer so that subsequent displays may be automatically customized.

The microprocessor 540 will issue selection commands to the processing and decompression function 555 according

to the code, signals from the user interface 535, and channel mapping and control data stored in memory 560. For instance, assume the viewer has not yet entered any commands to the user interface 535 other than selecting a
5 primary channel to view. The microprocessor will then determine which audio and video packets in the received data stream correspond to the primary signals of the particular programming service provider (e.g. network X). Using the packet PIDs, the appropriate video and audio
10 packets will be processed at function 555. Additionally, OSD data from the OSD processor 545 will be combined with the video signal at function 555 to form a composite video signal, which can allow, for instance, a split screen or overlay format with part of the screen of the device 580
15 displaying the OSD graphics, and part of the screen displaying the video data.

The output from function 555 will be a baseband signal carrying digital audio, video and graphics data. The baseband signal will be converted to an analog signal
20 at digital-to-analog (D/A) converter 550, then provided to a modulator 570. At the modulator 570, the analog signal is modulated at an RF carrier frequency which is set by the microprocessor 540, or at a default frequency (e.g. 60-66 MHz) which is compatible with the display device
25 580. In accordance with the present invention, the microprocessor 540 can change the pre-assigned channel mapping data of the audio and video packets corresponding to a particular programming service provider and channel designation. This allows the alternate audio and video
30 signals which are associated with the same program to be selected by the viewer and displayed on the device 580. For instance, the primary audio and video signals of the

service provider network X may be associated with the designator "channel 10". The present invention can modify the channel mapping such that alternate video and audio signals of "network X" are displayed on "channel 10."

5 In particular, consider the case where the viewer has commanded the user interface 535 to select an audio or video channel other than the primary channel. Upon receiving the user's command, the microprocessor will read the channel mapping and associated data stored in the
10 memory 560 to determine which data packets correspond to the user's selection. Upon determining the appropriate PIDs, the microprocessor 540 will provide a selection command to the decompression and processing function 555 to instruct it to process the corresponding data packets.
15 The new audio and video signal will then be provided to the D/A converter 550, and then to the modulator 570. The new baseband analog signal provides alternative audio and video signals of a service provider which are modulated at the same RF carrier signal as the primary audio/video
20 signals. The viewer thus has the ability to customize the programming service, thereby optimizing its entertainment and educational value.

 Figure 6 is a flow chart of the user selection process. At
25 block 610, software (e.g., object code) is downloaded or installed to the terminal and stored in memory. The object code, which is compiled source code that is written in a language which may vary according to the specific terminal platform, comprises a set of instructions for the
30 microprocessor 540 and OSD processor 545 of the terminal 70 of Figure 5. At block 620, channel mapping and other control data, such as the frequency table data, is

received via the packetized data stream and stored in memory. The channel mapping data includes pre-assigned channel designations on which the various programming service's audio/video signals are displayed. At block 630, the user selects the primary channel of a programming service provider via the user interface. At block 640, the audio and video packets of the selected primary channel are processed and displayed with the pre-assigned channel designation. At block 650, the user invokes the OSD graphic display to determine the availability of alternative audio and video signals which are associated with the selected programming service provider.

In some cases, such as when different programming service providers (e.g., network X and network Y) are covering the same or related events, it may be appropriate for the OSD graphics display to group the primary and/or alternative audio and video signals of the different programming services. In order to know that two or more service providers are covering the same event, corresponding data must be provided to the terminal via the downloaded code, channel mapping data, or other control data. The data may correlate audio/video data of an event from a single service provider which are provided in adjacent or non-adjacent locations in the spectrum of the received packetized data stream. Furthermore, the interface may allow the viewer to group selected signals.

At block 660, the user selects the desired alternative audio/video signals (e.g., sideline camera angle and audio feed of a sporting event). At block 670, the microprocessor of the terminal reads the memory to obtain and modify the channel mapping and other control data corresponding to the selected audio and video

signals. The microprocessor then issues a selection command to the decompression and processing function so that the corresponding audio and video packets are processed and displayed along with the OSD graphics.

5 Furthermore, the selection command is optionally provided to a modulator so the composite audio, video and graphics signal will be displayed on a pre-defined spectrum corresponding to the primary channel.

Accordingly, it can be seen that the present
10 invention allows a television viewer to select among available audio and video programming alternatives to customize a programming service according to his or her particular interests. The service provider transmits different audio and video signals, e.g. of a sporting
15 event, along with corresponding OSD graphics data, channel mapping and other control data in a packetized data stream to a cable system headend, or directly to a terminal at the viewer's home. At the terminal, the data is processed according to object code stored therein to provide the
20 viewer with a display that presents the available audio and video options. Based on the viewer's selections, the corresponding audio and video data packets are retrieved, processed and displayed on a primary channel designator of the programming service provider. Alternatively, the
25 programming service provider, cable system headend, or locally installed object code, may provide control data that allows the programming of two or more service providers to be grouped, such as when the same service providers are covering the same event. Or, the code which
30 is downloaded to the terminal may provide such grouping information. This can provide the viewer with an OSD display of the alternative audio and video signals of the

two or more programming services, thereby optimizing the viewer's control and ability to customize the programming. Moreover, in addition to audio and video signals, data such as statistics on a sports team or individual player, team schedule, or the like, may be provided via the data stream or code. Furthermore, the viewer may be provided with the capability to review a program segment via a re-run feature when appropriate memory and control means are provided.

Although the invention has been described in connection with various specific embodiments, those skilled in the art will appreciate that numerous adaptations and modifications may be made thereto without departing from the spirit and scope of the invention

CLAIMS:

1. A terminal for processing a packetized data stream including data corresponding to a primary signal and at least one alternative signal of a first programming service, said primary signal being associated with a first channel designator, said terminal comprising:

mapping means responsive to a selection command for mapping said alternative signal to said first channel designator; and

means responsive to said first channel designator for providing the data of at least one of said primary signal and said alternative signal to an output device for reproduction.

2. An apparatus in accordance with claim 1, wherein said data of said alternative signal comprises at least one of audio and video data.

3. An apparatus in accordance with claim 1 or 2, wherein said packetized data stream is compressed, said apparatus further comprising:

means for unpacking said data stream to recover said data corresponding to said primary signal and said alternative signal; and

decompressing means responsive to said selection command for decompressing the unpacked data of at least one of said primary signal and said alternative signal.

4. An apparatus in accordance with claim 3, further comprising:

means coupled between said decompressing means and said output device for modulating said alternative signal at a carrier frequency in response to said selection command.

5. An apparatus in accordance with one of the preceding claims, further comprising:

a user interface for providing said selection command in response to a user-provided command.

6. An apparatus in accordance with claim 5, further comprising:

an on-screen display (OSD) graphics processor operatively associated with said user interface, said OSD processor providing a graphical display to allow the user to choose said alternative signal via said user-provided command for reproduction by said output device.

7. An apparatus in accordance with claim 6, wherein said OSD processor provides a graphical display to allow the user to choose said primary signal and said alternative signal via said user-provided command for concurrent reproduction of data of at least part of said primary signal and at least part of said alternative signal by said output device.

8. A terminal for processing a packetized data stream including data corresponding to a signal of a first programming service which is associated with a first channel designator, and a signal of a second programming service, said terminal comprising:

mapping means responsive to a selection command for mapping said signal of said second programming service to said first channel designator; and

means responsive to said first channel designator for providing the data of said signal of said second programming service to an output device for reproduction.

9. An apparatus in accordance with claim 8, wherein said signal of said second programming service is associated

with a second channel designator which is different than said first channel designator.

10. A method for providing a packetized data stream including data corresponding to a primary signal and at least one alternative signal of a first programming service, said primary signal being associated with a first channel designator, said method comprising the steps of:

providing a selection command;

mapping said alternative signal to said first channel designator in response to said selection command; and

providing the data of at least one of said primary signal and said alternative signal to an output device in response to said first channel designator for reproduction.

11. A method in accordance with claim 10, wherein said data of said alternative signal comprises at least one of audio and video data.

12. A method in accordance with claim 10 or 11, wherein said packetized data stream is compressed, said method comprising the further steps of:

unpacking said data stream to recover said data corresponding to said primary signal and said alternative signal; and

decompressing the unpacked data of at least one of said primary signal and said alternative signal in response to said selection command.

13. A method in accordance with one of claims 10 to 12, comprising the further step of:

modulating said alternative signal at a carrier frequency in response to said selection command.

14. A method in accordance with any one of claims 10 to 13, wherein said selection command is provided in response to a user-provided command.

15. A method for processing a packetized data stream including data corresponding to a signal of a first programming service which is associated with a first channel designator, and a signal of a second programming service, comprising the steps of:

providing a selection command;

mapping said signal of said second programming service to said first channel designator in response to said selection command; and

providing the data of said signal of said second programming service to an output device for reproduction in response to said first channel designator.

16. A method in accordance with claim 15, wherein said signal of said second programming service is associated with a second channel designator which is different from said first channel designator.

17. A terminal for processing a packetized data stream substantially as hereinbefore described with reference to Figure 5 of the accompanying drawings.

18. A method of processing a packetized data stream substantially as hereinbefore described with reference to Figure 5 of the accompanying drawings.



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Claims searched: 1 to 18

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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): H4P (PPS & PPG), H4K (KTK) And
H4R (RCC, RCSC, RCSS, RCST & RCX)

Int CI (Ed.6): H04L (12/18 & 12/56), H04H (1/10 & 1/12) And
H04J (3/24)

Other: ONLINE : WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2301269 A VIDEO JUKEBOX	None
A	WO 96/13940 A1 MATRA	None
A	US 5452303 NEC	None

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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